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ABSTRACT

The types of positions that physicists accept to start their careers are evaluated through a survey conducted by the American Institute of Physics. It is suggested that the economic recession and declining job market has had an effect on the transition from a physics education to the start of a career. The amount of time spent by 1977-78 physics degree recipients in securing employment is tabulated as well as changes in occupational status of physics and astronomy degree recipients, characteristics of physics and astronomy doctorate recipients, employment status of doctoral physicists 6-18 months after graduation, factors influencing the length of postdoctoral fellowships, employment of doctoral-level physicists, background characteristics and employment status of physics masters, characteristics of physics masters and bachelors that influence time required to secure employment, and employment of astronomy bachelors. The results of the survey indicate that the majority of physics graduates at all three degree levels secured employment within two months after graduation. It is also indicated that almost 85 percent of the physics doctorate recipients who start employment with a potentially permanent position classify their work as physics-related. A total of two percent of physics graduates at each degree level were found to be unemployed and seeking employment. (SF)

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AIP report MANPOWER STATISTICS DIVISION

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EMPLOYMENT SURVEY 1978

by Susanne D. Ellis

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The surveys AIP conducts annually deal primarily with students and how they prepare themselves for their careers. Until 1970 the transition from a physics education to the start of a career was a straightforward process. However, the economic recession in the early 1970's called for a reexamination of many careers, especially that of the physicist. Initial employment for physicists at the three degree levels changed considerably from the 1960's with a certain proportion of the graduates taking up to six months to secure an acceptable job offer. Thus, the data collected each summer from physics degree recipients whose post-degree plans were employment, appeared to be incomplete unless a follow-up survey was introduced. This Employment follow-up Survey, conducted in December of each year, is designed to evaluate the kinds of positions physicists accept to start their careers.

Highlights of this report are:

1) The majority of the physics graduates at all three degree levels secured employment within two months after graduation.
2) Almost 85% of the physics doctorate recipients who start employment with a potentially permanent position classify their work as "physics related".
3) Only 2% of the physics graduates at each degree level are currently unemployed and seeking.

Figure I addresses itself to the question of how long does it take a graduate to secure initial employment which he or she can classify as potentially permanent? Thus as Figure I indicates 'postdocs' are excluded from the doctorate recipients. While the time spent seeking initial employment

Fig. I. Time spent by 1977-78 physics degree recipients in securing employment.

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Table I. Changes in occupational status of physics degree recipients between the summer of 1978 and the following winter.

Employment status reported in Graduate Student Survey, summer 1978	Current occupational status, winter 1978–79						
Doctorate recipients	'Postdoc'	Full-time employed	Employed p-t temp., other	Student	Not empl. and seeking	Total N	Total %
Newly accepted empl.	28	137	–	–	–	165	47
Continuing employment	7	18	–	–	2	27	8
'Postdoc'	107	12	–	–	1	120	34
Other graduate study	–	–	–	3	–	3	1
No immediate plans	–	1	2	–	–	3	1
Not empl. and seeking	8	16	3	–	5	32	9
N	150	184	5	3	8	350	
Total %	43	53	1	1	2		100%
Masters							
Newly accepted empl.		70	2	3	–	75	42
Continuing employment		34	3	1	1	39	22
Career military		9	–	–	–	9	5
Other graduate study		1	–	23	–	24	14
No immediate plans		1	1	1	–	3	2
Not empl. and seeking		21	2	2	2	27	15
N		136	8	30	3	177	
Total %		77	4	17	2		100%
Bachelors							
Newly accepted empl.		365	9	1	3	378	61
Continuing employment		69	5	2	2	78	13
Military service		54	1	–	–	55	9
Other (vol., temp.)		7	3	–	2	12	2
No immediate plans		4	6	–	2	12	2
Not empl. and seeking		67	8	2	6	83	13
N		566	32	5	15	618	
Total %		92	5	1	2		100%

varies for different levels, it is reassuring to note from **Figure I** that 51% of the doctors, 62% of the masters and 71% of the bachelors spent two months or less to find post-degree employment. The first set of bars in **Figure I** is intended to show what proportion at each of the three degree levels have positions lined up at the time of graduation.

Tables I and **II** highlight the major reason for conducting this survey: How has the occupational status of new graduates changed in a six-month period?* Each table includes all three degree levels with **Table I** presenting these changes for physicists and **Table II** for astronomers. Thus **Table I** shows how 9%, 15%, and 13%, depicting the groups of graduates who were not employed and seeking, declined to 2% each within a six months period.

The total number of astronomers who responded to this follow-up survey was 87, a total which includes all three degree levels. As **Table II** shows, only one astronomer classified himself as "not employed and seeking", but the number of respondents is too small to draw optimistic conclusions from that.

Table III singles out the employed doctorate recipients among the physicists and astronomers, and presents five characteristics for each group that could be expected to influence the type of employment these scientists accepted; namely, temporary postdoctoral fellowships or regular full-time employment. However, none of these characteristics appear to have a strong influence on the type of employment with the possible exception of the citizenship of physicists. In regard to subfields it may be surprising that solid state physicists comprise almost equal proportions of the 'postdocs' as of the regularly employed physicists, instead of comprising a much larger proportion of the latter group.

* *Although employment-oriented degree recipients from July 1977 through June 1978 are included, most of the respondents graduated in May or June 1978.*

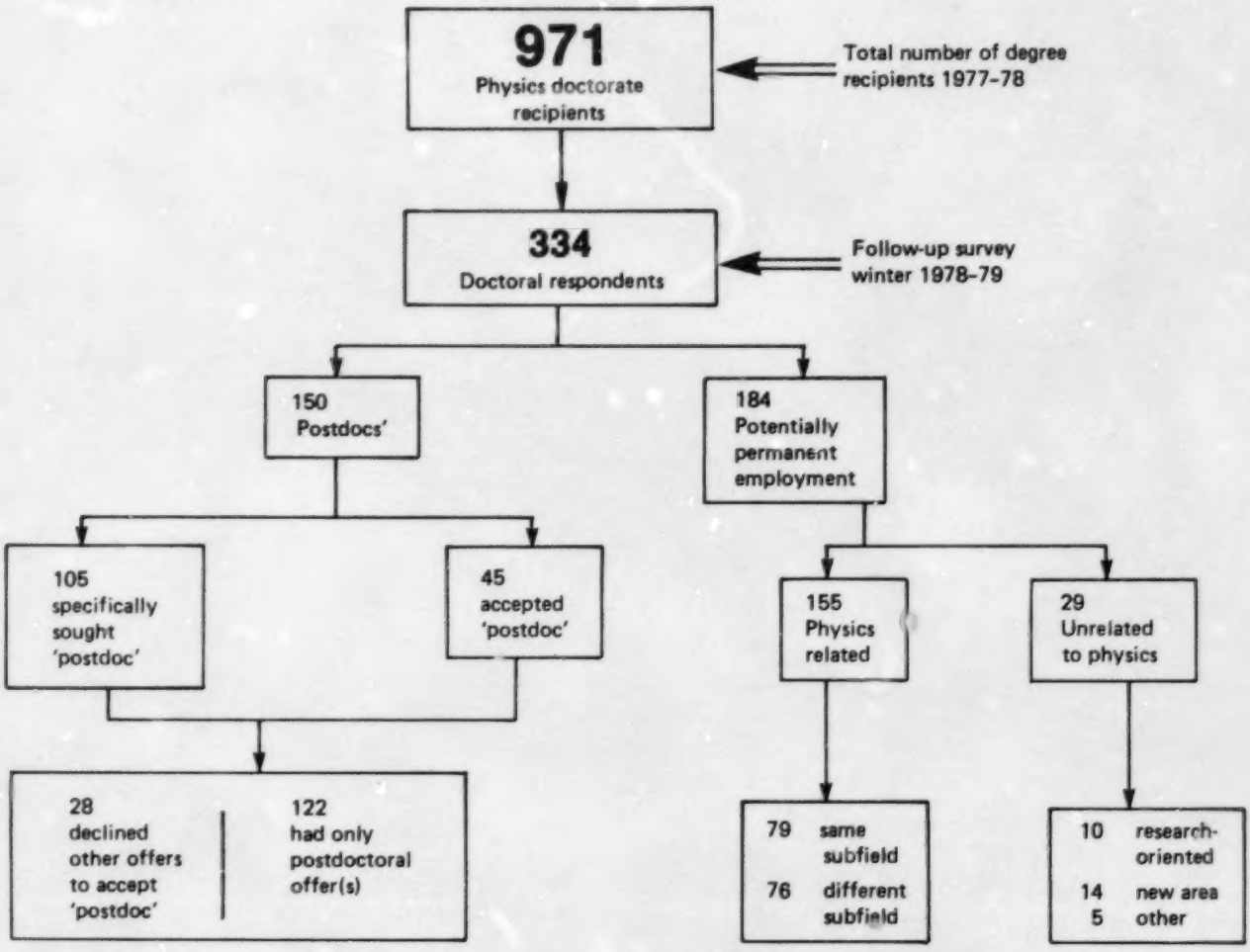
Table II. Changes in occupational status of astronomy degree recipients between the summer of 1978 and the following winter.

Employment status reported in Graduate Student Survey, summer 1978	Current occupational status, winter 1978–79						
Doctorate recipients	'Postdoc'	Full-time employed	Employed p-t temp., other	Student	Not empl. and seeking	Total N	Total %
Newly accepted empl.	4	6	–	–	–	10	23
Continuing employment	–	5	–	–	–	5	11
'Postdoc'	22	–	–	–	–	22	50
Not empl. and seeking	2	4	–	–	1	7	16
Total N	28	15	–	–	1	44	
Total %	64	34	–	–	2		100%
Masters							
Newly accepted empl.		4	–	–	–	4	40
Cont., incl. military		4	–	–	–	4	40
Not empl. and seeking		2	–	–	–	2	20
Total N		10	–	–	–	10	
Total %		100%	–	–	–		100%
Bachelors							
Newly accepted empl.		15	1	–	–	16	49
Cont., incl. military		1	2	–	–	3	9
Temporary empl.		1	–	–	–	1	3
No immediate plans		–	–	1	–	1	3
Not empl. and seeking		11	1	–	–	12	36
Total N		28	4	1	–	33	
Total %		85	12	3	–		100%

Table III. Characteristics of physics and astronomy doctorate recipients, 1977–78.

Characteristics	Physics 'Postdocs'	Physics Full-time employed	Astronomy 'Postdocs'	Astronomy Full-time employed	Characteristics
Sex					**Sex**
Female	5%	5%	4%	7%	Female
Male	95	95	96	93	Male
Age					**Age**
26 or younger	9%	4%	18%	13%	26 or younger
27 yrs.	19	9	18	33	27 yrs.
28 yrs.	18	18	12	7	28 yrs.
29 yrs.	12	12	12	7	29 yrs.
30 yrs.	16	14	18	–	30 yrs.
31–32 yrs.	17	20	18	20	31–32 yrs.
33 or older	9	23	4	20	33 or older
Citizenship					**Citizenship**
U.S.	79%	87%	89%	93%	U.S.
Foreign	21	13	11	7	Foreign
Type of research					**Type of research**
Experimental	58%	56%	40%	33%	Observational
Theoretical	30	32	32	60	Theoretical
Both	12	12	28	7	Both
Major subfields					**Major subfields**
Astrophysics	4%	5%	18%	7%	Cosmology, extragalactic, quasi-stellar objects
Electron, atomic & molec.	5	8	18	20	Interstellar matter and gaseous nebulae
Elem. particles	19	9	11	–	Solar system, space astronomy of the solar system
Nuclear	12	10	21	33	Stellar atmospheres and spectra, stellar evolution, solar and stellar interiors
Plasma	7	5			
Solid state	36	39	32	40	Other
Number of respondents	150	184	28	15	

Fig. II. Employment status of 1977-78 doctoral physicists 6-18 months after graduation.



All the tables in this report presenting doctoral graduates divide them into two groups: those who accepted temporary postdoctoral fellowships and those who secured potentially permanent positions. Their ratio right after graduation in the summer of 1978 was 1:2, but after the unemployed group changed its occupational status, (see **Table I**) and a larger proportion of 'postdocs' always responds to this survey, the ratio shown in **Figure II** approaches 1:1. To examine the choices involved in selecting post-degree employment, we assume that the quality of research a 'postdoc' offers, compensates the graduate for its temporariness as well as its lower salary. Nevertheless, of those 150 'postdocs' two-thirds specifically sought those fellowships and one-fifth of them declined offers with potential permanence to accept 'postdocs', as indicated in **Figure II.**

Offers of initial employment with potential permanence generally do not involve the two drawbacks referred to above. These more highly-paid positions therefore deserve closer examination. Thus the group of 184 doctorate recipients shown in **Figure II** were asked to evaluate their newly-accepted positions in terms of their relationship to physics, possible changes in subfield or other aspects that respondents feel may contribute to the evaluation of initial employment; **Figure II** summarizes the findings.

In recent years postdoctoral fellowships have been relatively easy to obtain, hence one can assume that not much time was spent by doctoral candidates seeking them. But when it comes to the length of time a 'postdoc' is for, a distinct change can be observed in 1978 from previous years. While the total number of graduates who accept 'postdocs' continues to decrease, the percentage of them getting fellowships for one year or less, has increased from 42% to 48%. In 1977 more than half of the foreign doctoral graduates who accepted 'postdocs' were offered two- or three-year fellowships; **Table IV** shows that in 1978 almost three-quarters of them were offered 'postdocs' of one year or less.

Looking at the major subfields with respect to the lengths of 'postdocs', one notices that elementary particles opposes the above-mentioned trend; approximately the same proportion of one-year 'postdocs' were offered, but those accepted for more than two years increased from 13% to 19%.

Table IV. Factors influencing the length of postdoctoral fellowships for 1977-78 doctoral level physicists.

Characteristics			Length of 'postdoc' < 1 yr.	1.5 to 2 yrs.	> 2 yrs.	Total %	Total N
Sex	Men		49%	47%	4%	100%	143
	Women		43	57	–	100	7
Citizenship	U.S.		43%	52%	5%	100%	118
	Foreign		72	28	–	100	32
Subfield of PhD	Elem. particles		27%	54%	19%	100%	27
	Nuclear physics		60	40	–	100	20
	Electron, atomic & molec.		63	37	–	100	8
	Solid state		50	48	2	100	52
	Other subfields		49	51	–	100	43
	Specifically sought 'postdoc'	yes	47%	49%	4%	100%	105
		no	53	42	5	100	45
Total		N	72	72	6		150
		%	48	48	4	100%	

All the doctoral graduates presented in **Table V** had accepted full-time potential permanent positions. A comparison of the employers for this group with those of the previous year reveals a shift away from academic employers and toward research institutes and industry. Consequently the distribution of work activities changed away from the combination of "teaching and research" (from 16% to 7%) and toward research which increased from 33% to the 45% shown in **Table V.**

Table V. Employment of 1977-78 doctoral level physicists

		Type of employer: Coll./ Univ.	Industry	Gov't incl. military	Research institute	Total for 1978 N	Total for 1978 %	Total for 1977 N	Total for 1977 %
Subfield of PhD	Astrophysics	4	4	1	1	10	5	–	–
	Electron, atomic and molecular	6	5	3	1	15	8	22	11
	Elem. particles	2	9	1	5	17	9	20	10
	Nuclear	5	11	2	1	18	10	25	13
	Plasma	–	6	1	3	10	5		
	Solid state	15	39	10	8	72	39	77	39
	Other	12	17	4	8	41	24	53	27
Work activity	Research	10	44	13	16	83	45	64	33
	Teaching and research	12	–	–	1	13	7	32	16
	Teaching	19	–	1	1	21	11	24	12
	Res. and dev.	1	16	2	5	24	13	34	17
	Engr. and dev.	–	26	4	2	32	17	26	13
	Other	2	5	2	2	11	7	17	9
Physics related work	Same subfield	23	31	13	12	79	43	91	46
	Different subfield	18	39	6	13	76	41	78	40
	Subtotal	41	70	19	25	155	84	169	86
Work unrelated to physics	Research oriented	3	5	1	1	10	5	14	7
	New area	–	12	1	1	14	8	8	4
	Other	–	4	1	–	5	3	6	3
	Subtotal	3	21	3	2	29	16	28	14
Total respondents in 1978		44	91	22	27	184			
		24%	49%	12%	15%		100%		
Total respondents in 1977		61	90	25	21			197	
		31%	46%	13%	10%				100%

Table VI. Background characteristics and employment status of 1977–78 physics masters.

Characteristics		Employment full-time	Employment part-time temp., other	Student	Unemployed and seeking		Total N	Total %
Sex	Female	70%	10%	15%	5%	100%	18	10%
	Male	77	5	16	2	100	159	90
Citizenship	U.S.	80%	6%	12%	2%	100%	163	92%
	Foreign	35	7	58	–	100	14	8
Age	23 or younger	50%	21%	29%	–	100%	14	8%
	24 yrs.	75	4	19	2	100	41	23
	25 yrs.	72	4	20	4	100	25	14
	26–28 yrs.	80	4	14	2	100	42	24
	29 or older	82	7	11	–	100	55	31
Type of institution last attended	Doctorate-granting	78%	2%	18%	2%	100%	124	70%
	Master's-granting	73	12	13	2	100	53	30
Major subfields	Physics education	73%	9%	18%	–	100%	10	6%
	Engineering physics	90	10	–	–	100	9	5
	Optics	70	–	18	12%	100	16	9
	Solid state	80	2	18	–	100	42	24
	General physics	69	8	19	4	100	23	13
Respondents in survey		136	8	30	3		177	100%

When relating the characteristics of physics masters to their current occupational status, the graduate's age, U.S. citizenship and his or her choice of a mostly applied specialty appear to be influential in securing full-time employment. **Table VI** presents five characteristics of the 177 masters who responded to this survey.

Since neither subfields nor types of research are of importance when employing physics or astronomy bachelors, only three of the characteristics shown in **Tables III, VI,** and **VII** were left to examine: they are sex, citizenship, and age, and none of them appear to influence the occupational status of the bachelors.

Table VII. Characteristics of 1977–78 physics masters that influence the time required to secure employment

Characteristics		Time spent finding employment: < 1 month	1–2 months	3–6 months	7–12 months	> 1 yr.	Total %	Total N
Sex	Female	47%	13%	33%	7%	–	100%	14
	Male	40	23	33	3	1%	100	130
Age	23 or younger	50%	13%	12%	25%	–	100%	10
	24 yrs.	29	29	37	–	5%	100	32
	25–26 yrs.	31	24	43	–	2	100	25
	27 or older	29	22	44	5	–	100	77
Type of graduate institution	Doctorate-granting	36%	23%	37%	3%	1%	100%	98
	Master's-granting	50	22	26	2	–	100	46
Type of employment	Physics related	41%	22%	33%	2%	2%	100%	111
	Unrelated to physics	38	24	35	3	–	100	33
Major employers	Industry	22%	27%	49%	1%	1%	100%	78
	College or University	58	12	21	8	1	100	22
	High school	58	25	17	–	–	100	12
	Government	58	18	12	12	–	100	15
	Military	86	14	–	–	–	100	12
Major work activities	Teaching	69%	15%	12%	4%	–	100%	23
	R & D	37	30	30	3	–	100	52
	Engineering	30	20	37	10	3%	100	30
	Programming	30	10	45	15	–	100	20
Total respondents		59	32	48	4	1	100%	144

While **Figure I** showed that a slightly larger proportion of the masters than the bachelors had secured employment before they graduated, it does not explore the characteristics of those graduates that may have contributed to this early success. **Tables VII** and **VIII** present these details by examining several background characteristics as well as broad aspects of the initial employment, and relate them to the time spent in securing specific types of jobs.

Contrary to what one may expect, an obvious conclusion to draw from **Tables VII** and **VIII** is that none of the characteristics listed have a significant influence on the time spent finding employment. Furthermore, over one-third of the graduates had jobs waiting for them as they received their degrees, and very few fall into the "7 months or longer" categories.

Were one to choose a characteristic that is expected to determine how quickly a new graduate accepts employment, it would be the graduate's view of whether or not the position offered is physics related. Settling for a position that is not related to physics ought to be compensated for by a shorter search; **Table VIII** supports this interpretation for the bachelors by showing that 39% of those who accepted jobs unrelated to their training started work immediately, while only 33% did so by choosing physics related positions.

The major employer of all non-doctoral physics graduates continues to be industry, and among the industrial companies those involved in electronics or computers are again cited most frequently.

To make astronomy the career goal, an undergraduate astronomy major ought to know that graduate training is required. The post-baccalaureate plans of the thirty astronomy bachelors, included in this report, concentrated on immediate employment rather than graduate study. Nearly two-thirds of these graduates secured employment in one month or less, and 90% of them started work within three months. Their comments on the questionnaires they completed indicate that their work deals with orbit determination for satellites, missile technology, spacelab simulators or telescope design. Despite these relevant work activities, most of the graduates, except for those who are teaching, classify their jobs as "unrelated to astronomy". On the other hand, only four out of the thirty astronomy bachelors state that they do not find their current positions challenging. **Table IX** gives an indication of where these astronomy bachelors are working and what types of work they perform. Of the three graduates who teach astronomy two are women.

Table VIII. Characteristics of 1977–78 physics bachelors that influence the time required to secure employment.

Characteristics		Time spent finding employment					Total	
		< 1 month	1–2 months	3–6 months	7–12 months	> 1 yr.	%	N
Sex	Female	38%	38%	24%	–	–	100%	89
	Male	35	36	26	2%	1%	100	509
Age	21 or younger	46%	35%	15%	4%	–	100%	26
	22 yrs.	33	39	26	2	–	100	245
	23 yrs.	31	40	28	1	–	100	140
	24–25 yrs.	32	34	31	2	1%	100	90
	26–29 yrs.	39	32	24	3	2	100	58
	30 or older	62	20	15	–	3	100	39
Type of bachelor's institution	Doctorate-granting	36%	34%	27%	3%	–	100%	245
	Master's-granting	27	42	26	3	2%	100	102
	Bachelor's-granting	39	36	24	1	–	100	251
Type of employment	Physics related	33%	36%	27%	3%	1%	100%	347
	Unrelated to physics	39	37	23	1	–	100	251
Major employers	Industry	30%	40%	28%	2%	–	100%	388
	High school	24	52	24	–	–	100	45
	Government	43	20	28	6	3%	100	60
	Military	68	12	20	–	–	100	50
Major work activity	Teaching	28%	49%	23%	–	–	100%	53
	R & D	39	33	25	2%	1%	100	113
	Engineering	30	38	28	3	1	100	183
	Programming	33	37	28	2	–	100	79
	Nonphysics professional	43	31	25	1	–	100	79
Total respondents		212	217	152	13	4	100%	598

Table IX. Employment of 1977–78 astronomy bachelors

Work activity	Type of employer: Industry	Government incl. military	University	High school	Total
Teaching	–	–	1	2	3
Data analysis	4	1	1	–	6
Dev. or design	–	4	–	–	4
Engineering	3	1	–	–	4
Programming	5	3	1	–	9
Skilled work	–	–	1	–	1
Professional (nontechnical)	1	2	–	–	3
Total	13	11	4	2	30

Additional publications available from the Manpower Statistics Division are:

Graduate Student Survey
Survey of Physics and Astronomy Bachelor's Degree Recipients
Survey of Enrollments and Degrees